CLAIMS

What is Claimed Is:

1. A screw rotor device for positive displacement of a working fluid, comprising:

a housing having an inlet port at a first end and an outlet port at a second end and a pair of cylindrical bores extending therebetween;

a female rotor having a helical groove, wherein said female rotor is rotatably mounted within said first end and said second end of said housing and has a periphery in close tolerance with said housing; and

a male rotor having a helical thread, said helical thread having a profile comprising a minor diameter arc and a tooth segment radially extending to a major diameter arc, wherein said male rotor is rotatably mounted within first end and second end of said housing and counter-rotates with respect to said male rotor, wherein said helical thread intermeshes in phase with said helical groove and said male rotor is in close tolerance with said housing, and wherein said helical thread and said helical groove bound a space within said cylindrical bores, seal the working fluid within in said housing, and transition between meshing with each other and sealing around said housing while maintaining said sealing of the working fluid in said space.

2. The screw rotor device according to claim 1, wherein said transition further comprises a small gap.

3. The screw rotor device according to claim 2, wherein said small gap is within said close tolerance.

4. The screw rotor device according to claim 1, wherein said male rotor and said female rotor have a length approximately equal to a single pitch of said helical thread and said helical groove, respectively.

5. The screw rotor device according to claim 1, wherein said helical thread and said helical groove intermesh at said inlet port and close off said spaces from said inlet to seal the working fluid in said housing.

6. The screw rotor device according to claim 1, wherein said male rotor is rotatably mounted about an axis extending between said first end and said second end of said housing, and wherein said profile is identically shaped in each plane perpendicular to said axis and passing through said male rotor at axial locations between said first end and said second end of said housing.

7. The screw rotor device according to claim 1, wherein a cross-section of said male rotor further comprises a first tooth, a second tooth and a toothless sector therebetween, said first tooth being subtended by a first arc angle and said toothless sector having a second arc angle that is at least twice said first arc angle.

8. The screw rotor device according to claim 7, wherein said toothless sector has a second arc angle that is at least thrice said first arc angle.

9. The screw rotor device according to claim 7, wherein said toothless sector has a second arc angle that is at least quadruple said first arc angle.

10. The screw rotor device according to claim 7, wherein said toothless sector has a second arc angle that is at least quintuple said first arc angle.

11. The screw rotor device according to claim 1, further comprising a plurality of threads and an equal plurality of grooves, each respective pair of threads and grooves intermeshing with each other in phase.

12. The screw rotor device according to claim 11, further comprising a valve operatively communicating with said outlet port.

13. The screw rotor device according to claim 12, wherein said helical thread further comprises a distal labyrinth seal.

14. The screw rotor device according to claim 13, wherein said housing further comprises an axial seal.

15. A screw rotor device for positive displacement of a working fluid, comprising:

a housing having an inlet port at a first end and an outlet port at a second end and a pair of cylindrical bores extending therebetween;

a male rotor having a plurality of helical threads and having a length less than twice the pitch of said helical threads, wherein said male rotor is rotatably mounted about a first axis extending between said first end and said second end of said housing, wherein a cross-section of said helical thread, in any plane perpendicular to said first axis, comprises a plurality of teeth and a plurality of toothless sectors between said teeth, wherein said teeth are each subtended by a first arc angle with respect to said axis and said toothless sectors each have a second arc angle greater than said first arc angle, said tooth having a profile comprising a minor diameter arc and a tooth segment radially extending to a major diameter arc in close tolerance with said housing; and

a female rotor having a plurality of helical grooves and having a length approximately equal to said male rotor, wherein said female rotor is rotatably mounted about a second axis and counter-rotates with respect to said male rotor and has a periphery in close tolerance with said housing, and wherein said helical grooves are equal in number to and respectively intermesh in phase with said helical threads.

16. The screw rotor device according to claim 15, wherein said length is approximately equal to a single pitch of said helical threads.

17. The screw rotor device according to claim 15, wherein said thread further comprises a first diagonal line and said groove further comprises a second diagonal line, said first diagonal line and said second diagonal line being in close tolerance with each other.

18. The screw rotor device according to claim 17, wherein said first diagonal line and said second diagonal line are straight.

19. The screw rotor device according to claim 18, wherein said helical threads and helical grooves form a buttress thread shape in a lengthwise cross-section of said male rotor and said

female rotor in a plane extending between said first axis and said second axis, wherein said buttress thread shape is comprised of parallel straight diagonal lines and a pair of opposing lines.

20. A screw rotor device for positive displacement of a working fluid, comprising:

a housing having an inlet port at a first end and an outlet port at a second end and a pair of cylindrical bores extending therebetween;

a male rotor having a plurality of helical threads and having a length less than twice the pitch of said helical threads, wherein said male rotor is rotatably mounted about a first axis extending between said first end and said second end of said housing, wherein a cross-section of said helical thread, in any plane perpendicular to said first axis, comprises a plurality of teeth and a plurality of toothless sectors between said teeth, wherein said teeth are each subtended by a first arc angle with respect to said axis and said toothless sectors each have a second arc angle greater than said first arc angle, said tooth having a profile comprising a minor diameter arc and a tooth segment radially extending to a major diameter arc in close tolerance with said housing;

a female rotor having a plurality of helical grooves and having a length approximately equal to said male rotor, wherein said female rotor is rotatably mounted about a second axis and counter-rotates with respect to said male rotor and has a periphery in close tolerance with said housing, and wherein said helical grooves are equal in number to and respectively intermesh in phase with said helical threads; and

wherein said helical threads and said helical grooves bound a space within said cylindrical bores, seal the working fluid within in said housing, and transition between meshing with each other and sealing around said housing while maintaining said sealing of the working fluid in said space, said transition further comprises a small gap within said close tolerance.